



Effects of low pH topical formulation and patented protocol on the incidence of cutaneous infections and associated antibiotic use and lost mat time in a division one wrestling program for an entire season

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Background Wrestling

With new CDC antibiotic stewardship mandates outbreaks of infectious diseases in athletes in competitive sports have stimulated considerable interest. The environments in which these athletes compete, practice, receive therapy for injuries, and travel, both domestically and internationally, provide varied opportunities for the transmission of infectious organisms¹. The most common mode of transmission in outbreaks was direct, person-to-person (primarily skin to skin) contact through active transmission.

A number of infectious agents can be transmitted through skin to skin contact. The differential diagnosis of skin lesions in wrestlers should focus upon the bacterial, viral, and fungal pathogens associated with infections characteristic of combat sports. For example, skin lesions in wrestlers may arise from bacterial pathogens such as *S. aureus*, viral pathogens such as poxvirus, which causes *Molluscum contagiosum*, or fungal pathogens such as *T. tonsurans* as well as *Herpes Gladitorium*. These infections occur in sports in which close personal contact occurs, including rugby, judo, and wrestling.² Furunculosis outbreaks, however, have been noted also in football and basketball athletes. One study showed that 25% of high school athletes in these sports developed furunculosis.³

In a review completed by BJ Anderson MD and published in *Current Sports Medicine Reports-American College of Sports Medicine*, rule changes in the late 1970s began to favor Olympic freestyle wrestling in an effort to make the sport more exciting. Under the new rules, team points were awarded for a superior decision on an individual match score, where beating an opponent by 8 points rewarded the team with 4 points and by 15 or more gave the team 5 points. This changed the complexion of high school and collegiate wrestling tremendously. Now if the opponent could not be pinned, the wrestler would instead focus on obtaining a superior decision, usually by using the strategy of repeatedly taking the opponent down for points and allowing the escape with a net gain in match points with each cycle. From 1968 to 2003, the amount of time a wrestler spent in the lock-up position with his opponent increased 62%. This increased time spent in the lock-up position was clearly one of the primary changes in wrestling style brought about by the team scoring rule changes. Skin-to-skin contact is the primary means of transmission and the increased time in the lock-up position has increased skin-to-skin contact, particularly on the face and neck. Because most athletes are right handed, opponents typically lock-up with the right side of their face in opposition. As expected, a review of several large *Herpes Gladitorium* outbreaks shows that more than 70% occur on the head, neck, and face, with a predilection for the right side.⁴

Sports medicine protocols have primarily focused on hard surface decontamination and may have overlooked daily protocols to reduce the risks associated with colonized skin. In the 1960's it was accepted skin infections were transmitted by contact with the mat or other hard surfaces. Today it is clearly recognized transmission is due to active skin to skin contact. The most important surface is the surface of the bodies largest organ- the skin. Reducing the bioburden prior to skin to skin contact may prove to be a highly effective protocol in attenuating active transmission when wrestlers practice and compete. One study, prompted by an alert from a local health department, noted an epidemic affecting 75% of a high school team's wrestlers⁵. Wrestling teams, often aware of the potential difficulties



associated with tinea corporis infection, fastidiously clean equipment and mats. Transmission however, is most likely primarily through skin to skin exposure and not through fomites.⁶ Without question it has been demonstrated the primary prevention consideration is lowering risks associated with active transmission of flora, fluids, viruses and fungi.⁷

The role of the athletic trainer is similar to that of the Infection Prevention professional in a hospital system. The IP's main role is to oversee quality interventional protocols and products to reduce the risk of infections. If sports medicine professionals are to reduce infections, it is paramount to consider not only hygiene standards and hard surface decontamination but also observe the methods used in our ICU's and environments with virulent risk. It can be contended the locker room risks are as virulent and possibly greater.

The purpose of this evaluation is to determine the effectiveness of a low pH topical formulation and protocol used to reduce central line associated blood stream infections (CLABSI) in ICU's in a wrestling program during an entire season and if results reduce lost mat time, antibiotic use and risks.

Topical Formulation (Theraworx®)

Theraworx is a topical technology clinically designed to enhance the skin's outermost layer the Stratum Corneum. The formulation uses a combination of skin healthy compounds and a low [pH] characteristic supporting the acid mantle of the skin- the primary factor in infection prevention and the health of the ever important permeability barrier. The technology is used in neuro ICU's across the country to lower infection risks associated with fecal and urinary incontinence and high rates seen in patients with indwelling catheters. According to the CDC catheter associated urinary tract infections account for 38% of all hospital acquired conditions and 13% of all nosocomial deaths. Theraworx and associated protocol have been shown to reduce the incidence of CAUTI minimally 70% when the patented protocol is complied with. Each CAUTI costs the hospital approximately \$17,000.00. The test formulation has also demonstrated efficacy in reducing central line associated blood stream infections. At St Jude Children's Hospital, the product is currently used to decolonize the patients entire body from multiple drug resistant organisms in children undergoing hematopoietic stem cell transplantation. The product was selected due to its safety and efficacy as these children who are taking immunosuppressant medications are not capable of tolerating topical antiseptics due to the development of cytotoxicities resulting in significant risk when considering the opportunistic nature of multiple drug resistant organisms. The product has a unique and safe mechanism and has demonstrated both bactericidal and bacteriostatic effectiveness which reduces the pathogenic bioburden and then prevents recolonization. The low [pH] mechanism is the main effect on the skin which also preserves healthy flora resulting in a super-normalized stratum corneum. As a result of this effect the product is rapidly growing in the vast wound market. The low pH formulation increases total oxygen and hemoglobin as confirmed through NIRS- near infrared spectroscopy, through a mechanism known as the bohr effect and accelerates wound healing which is paramount to infection prevention especially in wrestling where the skin is ever challenged through skin tears, mat burns, taping friction, razor burn and even acne. Blood-borne infection outbreaks occur in sports and wrestling is a high risk environment.

Method

The incidence of infections, lost mat time and antibiotic prescriptions are documented with each season. This was a retrospective approach comparing the 2014-15 incidents with 2015-16 incidents.

Participants



All 24 wrestlers active in the program were selected for the evaluation. Each athlete was given an 8oz. spray of the test formulation and instructed on the application protocols.

Application Protocols (Total body Decolonization/Zone of Inhibition)

Each athlete was instructed to spray the entire body to reduce the bioburden prior to each practice or competitive match and again after the shower following practice or competition. The daily decolonization protocol is the protocol used in the ICU setting. If the athlete's skin was compromised in any way such as minor abrasion, scratch, friction sensitivity, razor burn or mat burn a zone of inhibition protocol was implemented to accelerate healing and to protect the area from transient pathogenic flora. The athletes were instructed to spray the compromised area and cover the area and surrounding tissue with a six- inch radius covering on all sides. The protocol was to spray, allow to air dry (3) times a day for 4 days.

Data Collection

All 2014-15 incidents for bacterial infections, herpes gladiatorum and secondary bacterial infections from fungal infections were analyzed. Fungal infections were not considered as the NCAA does not require lost mat time due to fungal infections. Lost mat time and antibiotic prescriptions were analyzed and then compared with the 2015-16 season which implemented the patented product and protocol. The athletes used 2% chlorhexidine in the 14-15 season but were not compliant due to its drying effects on the skin and was further complicated when athletes limited their fluid intake further for weigh ins resulting in skin reactions.

Results

During the 2014-15 season 57% of the athletes developed a bacterial infection with the most common being impetigo. During the 2015-16 season there were no incidences of bacterial infections or impetigo. During the 2014-15 season twelve of the 24 athletes received antibiotic prescriptions compared with 4 during the 2015-16 season. There were no new herpes gladiatorum outbreaks and no secondary infections during 2015-16 which is unprecedented. In the 2014-2105 season there was a total of 20 lost mat days and during the 2015-16 season there were no lost mat days due to bacterial infections which is also unprecedented. During the 2014-15 season there were numerous adverse reactions to 2% chlorhexidine and during the 2015-16 season were not any adverse reactions reported to the test formulation which encouraged the athletes to comply.

Discussion

The implementation of Theraworx® and patented protocols resulted in overall reductions in cutaneous infections, antibiotics and lost mat time. One of the athletes had severe cystic acne and for the previous four years was prescribed prophylaxis low dose antibiotics throughout the season. Despite this approach he had numerous infections in the previous four years and even one hospitalization. After daily use of the test formulation his case of acne improved which resulted in the discontinuation of the prophylaxis treatment and despite the discontinuation of low dose antibiotic regimen he had an entire season infection free without any lost mat time.

The Theraworx and simple protocol resulted in improved outcomes and reduced risks. Considering the virulent nature of active transmission these outcomes demonstrate adding a total body (skin) decolonization protocol and a zone of inhibition protocol with a safe and effective product is paramount and enhanced prevention program. As the infection prevention specialist for sports programs the athletic trainer should strongly consider adapting ICU or hospital protocols proven to reduce the incidence of infections. Considering the costs and risks of treating an infection the intervention is cost effective at an



estimated .40 to .50 cents per day per athlete. Overall reporting reduced bacterial and herpetic infections along with zero lost mat time will significantly help with recruiting as families are highly interested in infection prevention programs and the health and safety of their children.

References

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